Chapter XI.—CONSUMPTION OF FUEL IN MANUFACTURING INDUSTRIES.

Methods of consumption of fuel.—Fuel is used in manufacturing in three different ways. First, and most important, it is employed for generating power by means of steam engines or internal-combustion engines; second, to produce heat which is applied directly to materials to transform them or to facilitate their manipulation; and third, as a material which enters into the actual composition of the product.

The only important industries using fuel in the manner last described are the charcoal industry, where by a process of slow partial combustion wood is transformed into charcoal; the coke industry, where coal is transformed into coke by the combustion or distillation of the lighter hydrocarbons; and the gas industry, in which coal and oil form important constituent materials. Besides these, there are the manufactured fuel industry, and the manufacture of bone, carbon, and lamp black, both of which are minor industries.

There are about 35 industries in which, by the combustion of coal or some other form of fuel, heat is applied directly to material in the process of manufacture. Among these the most important are the brick, tile, and pottery, foundry and machine-shop, glass, and blast-furnace industries, the steel works and rolling mills, the various metal smelting industries, the lime and cement industries, petroleum refining, and the salt industry.

Quantity of different kinds of fuel consumed in all manufacturing industries combined.—The census inquiry in regard to fuel was designed to ascertain the quantity used in manufacturing processes or for the development of power. Establishments using fuel for lighting or heating purposes only were not asked to report the amount used. On the other hand, when fuel was so used and was also used for the development of power or in the process of manufacture, no attempt was made to separate the quantities used for the different purposes, but the total consumption was reported.

Table 218 shows the quantity of the principal kinds of fuel reported by all manuacturing establishments in 1914 and 1909.

Table 218	QUAN'	QUANTITY.			
KIND.	1914	1909			
Anthracite coal, tons of 2,240 pounds Bituminous coal, tons of 2,000 pounds. Coke, tons of 2,000 pounds. Oll, including gasoline, barrels. Gas (excluding blast-furnace gas), 1,000 cubic feet.	1 166, 699, 827	14, 339, 220 1 161, 793, 058 37, 925, 338 34, 331, 632 269, 640, 535			

¹ Includes bituminous coal used as material in the manufacture of coke.

The figures for bituminous coal cover all that was consumed in the manufacture of coke. Under "coke" are reported both oven and gas-house coke. The greater part of the oil used as fuel was crude petroleum. There were, however, large quantities of the products of petroleum refining—gasoline, naphtha, gas oil, fuel oil, and illuminating oil—reported under this heading. Natural gas formed by far the larger proportion of the total quantity of gas reported. A great many concerns use coal for power or other purposes by converting it into "producer" gas. In such cases the quantity of coal consumed, rather than that of gas made and consumed, was reported. The blast-furnace gas used as fuel is not included in the table.

The census schedule for manufactures called specifically for the five kinds of fuel named in the above table. Charcoal is of some importance as a fuel in manufacturing. In the blast-furnace industry, the leading consumer of charcoal, 29,083,978 bushels, equivalent to 319,924 tons, assuming the average weight of a bushel to be 22 pounds, were used in 1914. A large part of the charcoal manufactured is made in wood distillation plants.

Fuel consumed in individual industries.—Statistics as to the amount of the different kinds of fuel consumed in 1914 are shown in Table 220 for each of the 340 industries for which separate statistics can be given. Table 219 shows, for 1914 and 1909, the total cost of fuel, including rent of power, and the quantities of the different kinds of fuel reported by each of the 59 industries showing the largest expenditures for fuel and rent of power.

The quantity of wood consumed as fuel was not a part of the census inquiry for 1914. Many establishments, especially those in the tanning and woodworking industries, use large quantities of spent tanbark slabs, sawdust, etc., of which no account is kept as to quantity or value. In the bakery, clay-working, lime, wood distillation, and other industries that use large quantities of purchased wood for fuel, the cost is included, although the quantity is not shown.

The blast-furnace industry leads in cost of fuel consumed, although a decrease of approximately \$20,000,000 is shown. Coke is the principal fuel used in this industry, the consumption for 1914 being 26,335,234 tons, or 80.9 per cent of the total quantity used in all industries. In the consumption of other kinds of fuel this industry holds a subordinate place. The statistics for gas used in this industry, as

shown in the table, do not include blast-furnace gas.

In 1914, 41 blast-furnace establishments reported the utilization of over 1,400,000,000 thousand cubic feet of blast-furnace gas, of which 355,000,000 thousand cubic feet were used in other departments of the plants for steam and power purposes. The quantity and value of this gas are omitted from the table because it was produced and consumed within the industry and was not a primary fuel.

The coke industry was second in importance in the amount expended for fuel. The principal material of this industry is bituminous coal, of which 50,457,474 tons were used in 1914, or 30.3 per cent of the total for all industries. Most of this is simply transformed into coke, as very little power is required in the manufacture of coke.

The steel works and rolling mills ranked third in fuel consumption in 1914, as measured by expenditures for fuel. Much fuel is required in this industry, both for smelting and heating the materials and for generating power for the operation of heavy machinery required for all branches of the industry.

The manufacture of gas requires a large expenditure for coal, coke, and crude oil.

which are used in the various processess of manufacture.

Among other large consumers of fuel will be found the brick, tile, and pottery, cement, chemical, cotton-goods, foundry and machine-shop, glass, manufactured ice, malt liquors, paper and wood pulp, petroleum-refining, and metal-smelting industries, and steam-railroad repair shops.

Fuel consumed, by divisions and states.—Table 222 (p. 567) presents statistics of the quantity of fuel consumed in each of the states, and also for the geographic

divisions.

CONSUMPTION OF FUEL IN 59 LEADING-FUEL-CONSUMING INDUSTRIES: 1914 AND 1909.

Table 219			FUEL CONSUMED.				
INDUSTRY.	Cen- sus year.	Cost of fuel and rent of power.	Anthracite coal (tons of 2,240 pounds).	Bitumin- ous coal (tons of 2,000 pounds).	Coke(tons of 2,000 pounds).	Oil, in- cluding gasoline (barrels).	Gas 1 (1,000 cu- bic feet).
All industries	1914 1909		14,724,265 14,339,220	166,699,827 161,793,058	32,539,325 37,925,338	48,689,232 34,331,632	285,609,876 269,640,535
Agricultural implements	1914	2,507,394	8,863	555,271	104,386	240,060	234,349
	1909	2,042,974	15,114	550,085	98,819	244,759	313,412
Automobiles, including bodies and parts.	1914	4,656,102	31,393	662,224	23,560	384,248	2,038,860
	1909	1,661,724	17,346	319,497	14,282	86,873	385,468
Boots and shoes, including cut stock and findings.	1914	2,310,903	80,618	302,766	3,119	4,371	201,892
	1909	1,847,885	45,089	285,545	2,124	4,324	128,314
Brass, bronze, and copper products.	1914	3,831,780	127,828	378,306	75,812	310,910	464,259
	1909	3,005,514	206,396	589,309	59,152	206,852	248,798
Bread and other bakery products.	1914	9,591,187	470,341	382,882	254,313	220,141	4,619,113
	1909	7,375,847	383,390	250,165	195,971	151,371	2,732,911
Brick, tile, pottery, and other clay products.	1914	26,601,525	291,366	9,170,010	66,872	1,921,256	23,821,028
	1909	25,348,623	334,684	8,799,778	45,347	1,410,740	26,368,992
Butter, cheese, and con-	1914	3,909,540	36,069	831,549	7,146	213,359	213,373
condensed milk.	1909	2,771,983	47,344	588,169	1,069	94,325	215,318
Canning and preserving	1914	2,166,400	48,705	415,732	2,992	344,764	224,543
	1909	1,551,363	37,613	287,294	2,156	165,042	130,434
Carriages and wagons and materials.	1914	1,842,865	47,516	379,432	12,269	64,567	234,191
	1909	1,771,984	52,258	451,304	18,741	44,176	477,367

Not including blast-furnace gas.

CONSUMPTION OF FUEL IN 59 LEADING FUEL-CONSUMING INDUSTRIES: 1914 AND 1909—Continued.

Table 219—Continued.			FUEL CONSUMED.				
INDUSTRY.	Cen- sus year.	Cost of fuel and rent of power.	Anthracite coal (tons of 2,240 pounds).	Bitumin- ous coal (tons of 2,000 pounds).	Coke (tons of 2,000 pounds).	Oil, in- cluding gasoline (barrels).	Gas (1,000 cu- bic feet).
Cars and general shop con-	1914	\$12,482,370	506,696	5,486,405	79,597	2,508,703	1,829,902
struction and repairs by	1909	8,465,983	438,349	5,255,477	54,827	982,329	1,116,127
steam-railroad companies. Cars, steam-railroad, not in- cluding operations of rail-	1914 1909	2,749,760 2,097,659	34, 978 38, 895	698, 097 664, 638	70,886 113,013	294, 826 140, 725	1,221,695 552,803
road companies.	1914	20,271,662	226,474	6,731,438	20,072	2,502,065	5,525,894
	1909	13,153,180	259,220	4,815,758	4,103	1,515,697	14,721,568
Chemicals	1914	11,203,672	491,603	2,667,248	275,440	500,668	2,744,939
	1909	8,047,443	650,482	2,161,783	63,522	110,276	1,300,770
Clothing, men's, including shirts.	1914	2,183,947	49,433	118,445	2,354	8,327	498, 945
	1909	2,240,019	55,770	89,342	1,013	8,904	828, 622
Clothing, women's	1914	1,756,814	11,980	17,958	439	939	261, 561
	1909	1,676,832	21,405	14,897	76	1, 295	377, 872
Coke, not including gas- house coke.	1914 1909	64,832,328 60,905,891		50,457,474 59,030,005			
Confectionery	1914	1,756,431	81, 153	216,920	13,805	23,333	688, 961
	1909	1,308,881	72, 630	169,556	18,052	5,662	404, 626
Copper, tin, and sheet-iron products.	1914	2,646,518	63,454	458,576	20,400	140,330	1,529,565
	1909	2,252,642	51,448	334,754	14,917	85,096	1,337,837
Cotton goods, including cotton small wares.	1914	17,860,740	313,531	3,634,223	15,537	24,755	42,846
	1909	13,985,896	415,604	3,327,802	20,605	38,792	68,106
Cutlery and tools, not elsewhere specified.	1914	1,474,246	40,731	188,715	9,441	75,472	1,126,445
	1909	1,143,740	47,253	188,201	11,248	77,194	747,731
Dyeing and finishing tex- tiles, exclusive of that done in textile mills.	1914 1909	4,771,997 4,451,077	490,587 593,093	896,589 869,216	97 2,576	31,869 10,037	143,953 64,657
Electrical machinery, apparatus, and supplies.	1914	4,607,861	66,841	769,260	26,378	125,523	2,767,856
	1909	3,056,066	87,096	632,870	20,123	104,467	1,761,969
Fertilizers	1914	1,881,809	13,451	433,359	2,033	27,851	49,631
	1909	1,452,809	20,698	462,023	6,148	19,721	111,859
Flour-mill and gristmill products.	1914	7,780,149	56,953	1,809,968	13,941	441,693	1,627,255
	1909	6,980,675	67,459	1,880,702	3,347	424,386	3,037,000
Food preparations, not elsewhere specified.	1914	2,236,975	45,276	387,200	12,987	72,064	991,29
	1909	1,333,497	31,712	272,392	9,092	35,832	368,19
Foundry and machine-shop products.	1914	28,880,719	519,813	4,300,909	1,473,656	965,125	12,558,076
	1909	23,750,838	624,958	4,220,640	1,919,916	677,828	13,637,341
Furniture and refrigerators	1914	3,291,806	62,165	785,105	17,565	20,644	267,055
	1909	2,571,562	54,427	728,841	17,009	7,540	181,46
Gas, illuminating and heating.	1914	53,894,193	947,261	6,078,299	1,084,217	13,482,655	3,372,563
	1909	39,196,031	898,984	4,668,096	759,245	11,816,282	605,408
Glass	1914	10,934,928	41,372	2,252,268	16,770	867,836	43,336,323
	1909	7,523,937	17,906	1,859,001	17,393	468,894	43,711,519
Hosiery and knit goods	1914	2,686,957	118,071	484,268	2,849	2,476	40,764
	1909	1,970,277	124,420	441,187	1,080	2,182	33,86
Ice, manufactured	1914	11,340,469	213,541	3,386,275	30, 493	1,292,008	7,592,003
	1909	7,780,397	244,396	2,430,454	6, 872	905,952	4,348,925
Iron and steel, blast furnaces.	1914	88,586,592	47,060	1,892,357	26,335,234	80,474	242,218
	1909	108,536,921	273,543	1,166,135	31,649,865	19,446	274,699
Iron and steel, steel works and rolling mills.	1914	55,447,804	558,723	20,343,767	495,214	3,011,192	81,310,122
	1909	46,136,725	765,145	19,759,678	648,637	2,063,736	86,440,03
Iron and steel forgings, not made in steel works or rolling mills.	1914 1909	1,828,462 1,087,088	18,068 27,231	285,573 241,387	21,737 29,895	323,875 165,875	961,363 612,046
Leather, tanned, curried, and finished.	1914	3,757,026	89, 140	1,124,444	2,489	67,252	527, 657
	1909	3,292,831	98, 724	1,028,215	806	46,129	598, 532

CONSUMPTION OF FUEL IN 59 LEADING FUEL-CONSUMING INDUSTRIES: 1914 AND 1909—Continued.

Table 219—Continued.			FUEL CONSUMED.				
INDUSTRY.	Cen- sus year.	Cost of fuel and rent of power.	Anthracite coal (tons of 2,240 pounds).	Bituminous coal (tons of 2,000 pounds).	Coke (tons of 2,000 pounds).	Oil, in- cluding gasoline (barrels).	Gas (1,000 cu- bic feet).
Lime	1914	\$3,534,377	76,141	677,071	60,159	82,447	673,853
	1909	3,439,986	106,929	674,304	71,471	33,147	1,424,724
Liquors, distilled	1914	1,832,521	8,839	909,617	1,916	. 65,141	79,316
	1909	1,500,049	25,310	808,089	7,011	48,258	189,936
Liquors, malt	1914	10,470,018	571,588	2,749,600	11,198	725,672	3,314,070
	1909	8,570,892	554,029	2,424,798	11,530	527,089	3,649,380
Lumber and timber prod-	1914	7,461,399	76,873	1,417,485	4,996	507,546	492,694
ucts.	1909	5,082,287	79,330	1,134,218	5,854	144,499	521,034
Marble and stone work	1914	2,824,182	54, 227	485, 850	8,279	28, 634	151, 403
	1909	2,546,081	49, 962	682, 447	1,149	20, 238	133, 436
Oil, cottonseed, and cake	1914	4,010,450	5,507	1, 232, 031	1,762	248, 806	1, 519, 198
	1909	3,144,795	8,583	828, 357	800	376, 789	372, 880
Paint and varnish	1914	1,592,230	81,566	301, 554	25, 461	23,884	366, 695
	1909	1,306,297	66,597	299, 930	24, 667	19,613	269, 36 7
Paper and wood pulp	1914	24, 261, 348	741,177	6, 268, 853	15,455	635,329	2, 26 0, 562
	1909	18, 320, 266	558,677	5, 460, 314	500	584,536	6, 485, 293
Paving materials	1914	2,098,737	11,559	665, 802	2,933	127, 219	498, 951
	1909	202,921	12,184	54, 811	1,009	3, 598	195, 1 5 3
Petroleum, refining	1914	13, 567, 284	1,367,429	2, 045, 485	157,621	7, 455, 918	10, 993, 746
	1909	8, 376, 383	1,347,519	1, 264, 841	99,595	3, 473, 758	7, 519, 859
Printing and publishing	1914	8,605,057	165, 903	351,395	4, 830	52,849	2, 270, 571
	1909	7,601,152	154, 932	348,698	2, 895	41,265	1, 633, 886
Rubber goods, not elsewhere specified.	1914	2,744,005	68,793	919,066	348	8,778	371, 283
	1909	1,394,287	59,372	479,906	25	1,346	52, 173
Salt	1914	1,817,573	85,894	714, 402	535	55, 443	869, 339
	1909	1,590,746	108,816	642, 373	15	85, 074	1, 688, 731
Shipbuilding, including boat building.	1914	1,418,368	13,441	251, 820	10,548	122, 929	404, 785
	1909	1,191,654	12,080	301, 501	10,725	89, 916	274, 071
Silk goods, including throw-	1914	2,322,684	1,053,755	249, 963	3,601	2,962	148, 252
sters.	1909	1,687,981	242,771	155, 256		3,072	49, 673
Slaughtering and meat packing.	1914	8, 584, 177	226, 995	2, 802, 845	14,340	1,203,412	2, 083, 407
	1909	6, 700, 834	193, 935	2, 512, 864	976	1,102,550	1, 091, 164
Smelting and refining, copper.	1914	13, 471, 917	299, 480	812,196	744, 256	2,303,755	10, 615
	1909	13, 320, 517	310, 953	1,081,031	1, 008, 059	658,923	3, 889
Smelting and refining, lead.	1914 1909	3, 883, 589 3, 508, 126	31,958	358, 484 427, 479	389, 826 351, 968	186,556 99,157	90, 656 47, 393
Smelting and refining, zinc	1914	4, 115, 854	655, 766	1,066,525	92, 595	145, 811	22,336,089
	1909	2, 218, 876	432, 161	634,932	52, 172	41, 595	11,676,995
Soap	1914	1,618,833	83,378	515,356	2,850	36,150	70, 948
	1909	1,265,851	55,528	461,206	1,389	69,347	57, 385
Sugar, beet	1914	2, 726, 525	37, 235	682, 693	37, 854	803,698	4, 789
	1909	1, 899, 468	8, 981	565, 672	28, 300	554,174	3 8 3
Sugar, refining	1914 1909	3, 985, 160 2, 866, 371	451,310 511,640	875, 882 542, 148	1,624 362	748, 5 33 578, 6 33	453
Wire	1914	1,813,172	30, 067	523, 603	14,329	88,979	415, 873
	1909	1,640,172	84, 208	518, 121	22,280	71,663	217, 620
Woolen, worsted, and felt goods, and wool hats.	1914	7, 525, 349	257, 433	1,608,872	1, 524	43, 207	64,57
	1909	6, 489, 196	277, 755	1,525,988	6, 985	26, 611	104,746
All other industries	1914 1909	51, 557, 969	2, 048, 855 1, 924, 928	9, 230, 065 9, 129, 578	339, 938 380, 959	2,389,943 3,534,042	32,807,713 23,736,31